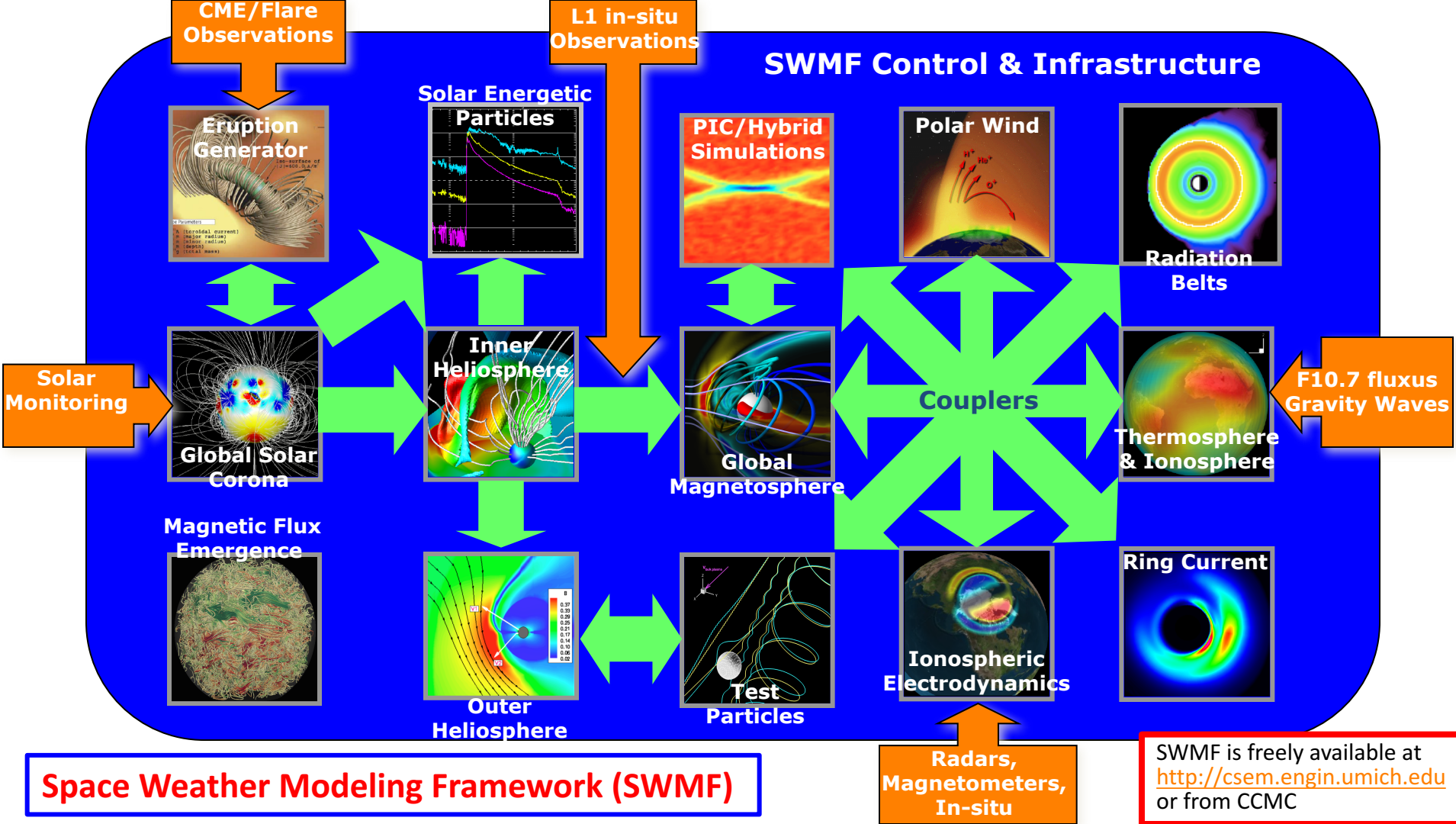


SWMF at the CCMC



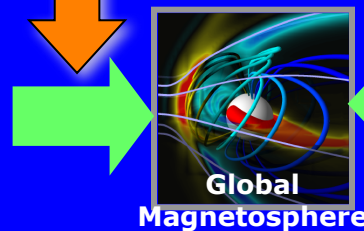
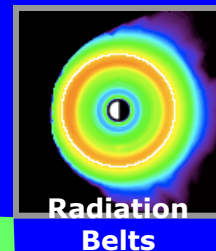
**Tamas Gombosi, Dmitry Borovikov, Yuxi Chen,
Bart van der Holst, Ward Manchester,
Igor Sokolov, Gabor Toth**

University of Michigan

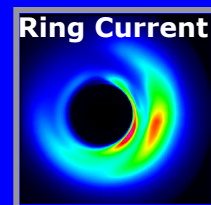
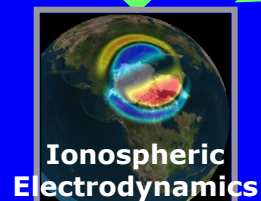


**L1 in-situ
Observations**

SWMF Control & Infrastructure



Couplers

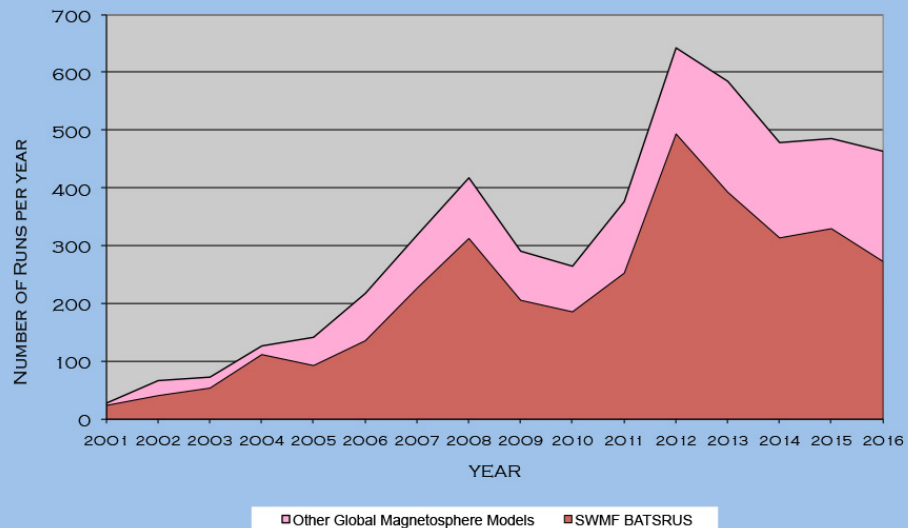


**Radars,
Magnetometers,
In-situ**

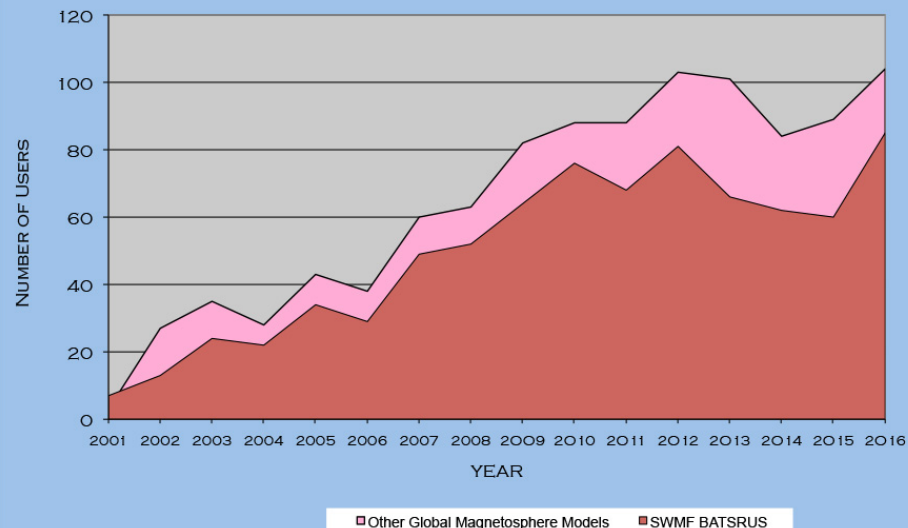
SWMF/Geospace

SWMF/Geospace at the CCMC

ROR RUNS PER YEAR - GLOBAL MAGNETOSPHERE



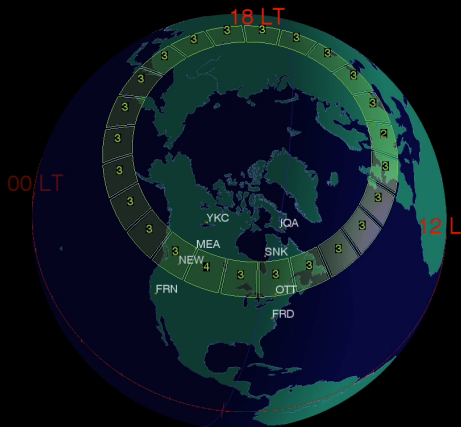
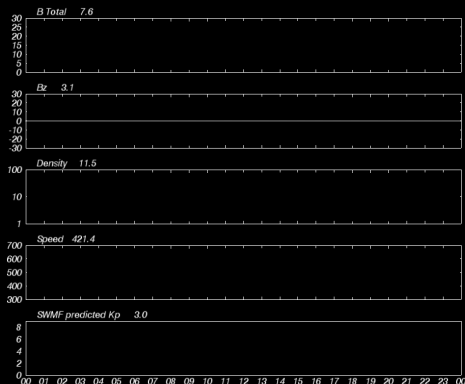
ROR USERS PER YEAR - GLOBAL MAGNETOSPHERE



SWMF/Geospace at NOAA/SWPC

Real-Time SWMF Geospace [St. Patrick's Day Storm]

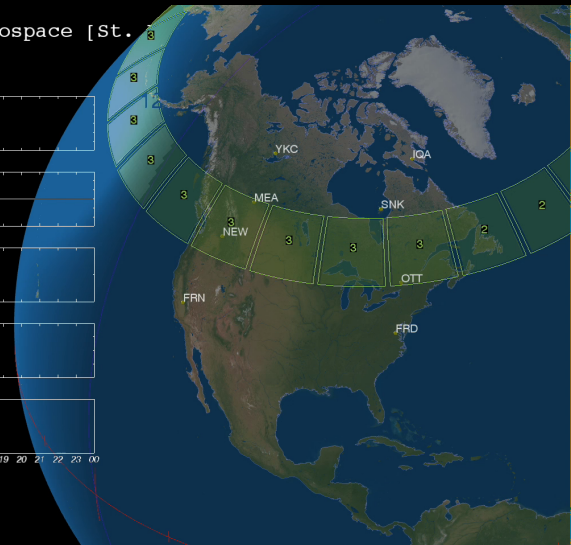
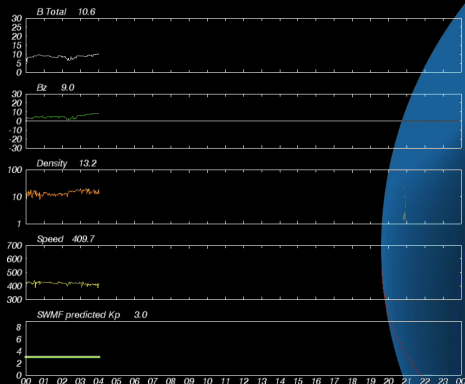
2015-03-17 00:00:00



Space Weather Prediction Center

Real-Time SWMF Geospace [St. Patrick's Day Storm]

2015-03-17 04:02:00

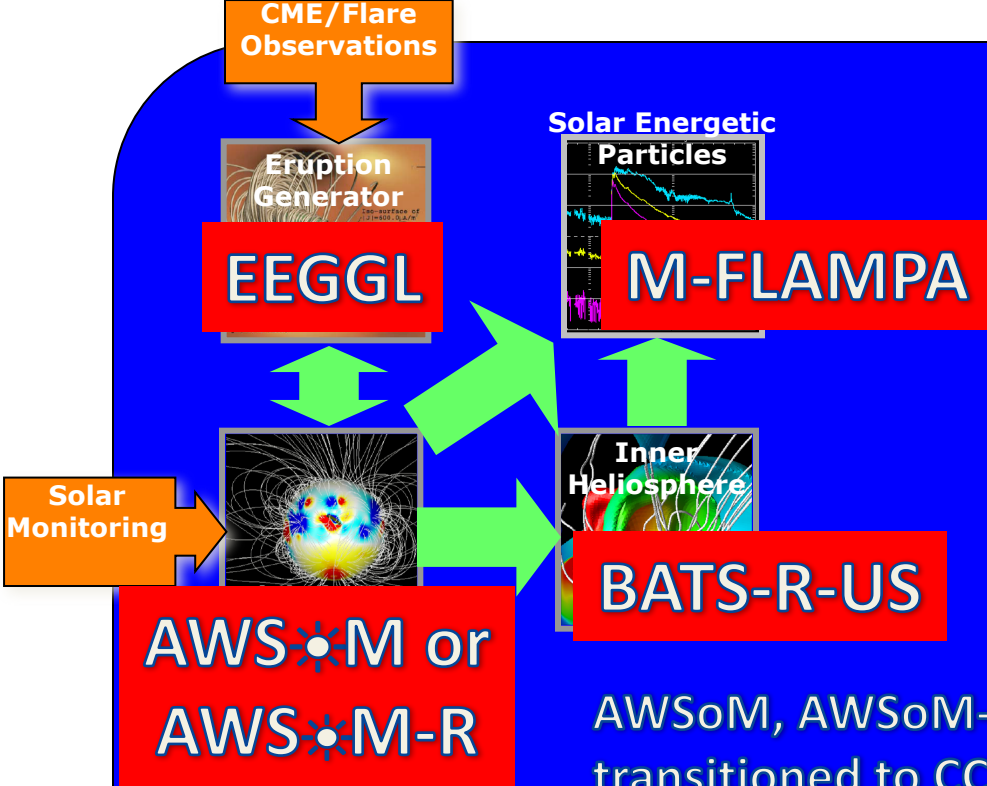


Space Weather Prediction Center

Courtesy of George Millward (NOAA/SWPC)

 SWMF/Geospace is operational since October 2016

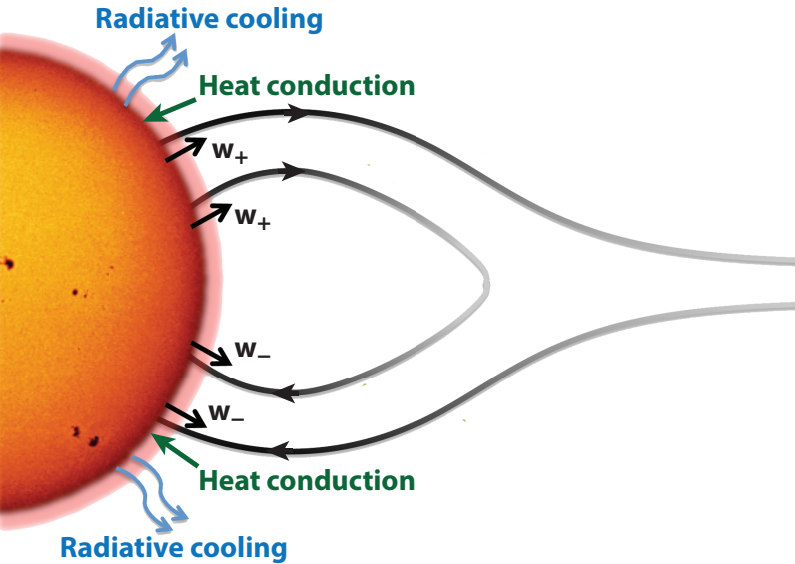
SWMF Control & Infrastructure



AWS•M, AWS•M-R, BATS-R-US and EEGGL are transitioned to CCMC

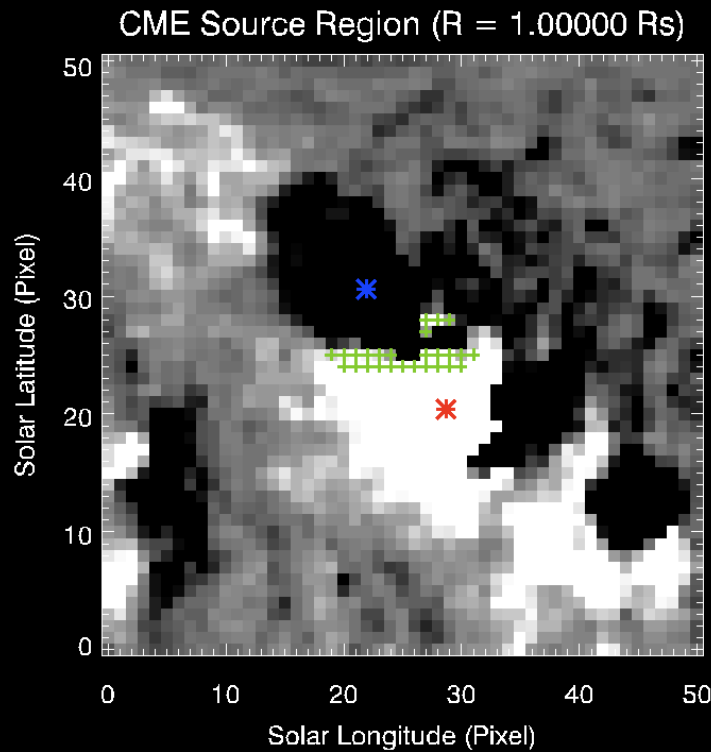
M-FLAMPA development is in final stage, it will be transitioned to CCMC by the end of calendar 2017

SWMF/AWS-M(-R)



- Between $1R_s$ and $1.15 R_s$ $\mathbf{u} \parallel \mathbf{B}$ and $u \ll V_{\text{slow}}, V_A, V_{\text{fast}}$
- Inner boundary of AWS-M-R is at $1.15 R_s$
- Each boundary cell center is connected to the upper chromosphere by a magnetic field line
- Quasi-steady-state mass, momentum and energy transport is solved along the connecting field line (1D equations)
- The many small cells in the lower corona of the AWS-M model are avoided \Rightarrow AWS-M-R is ~ 100 times faster \Rightarrow enables faster than real-time Sun to-Earth space weather prediction
- Both AWS-M and AWS-M-R are installed and running at CCMC**

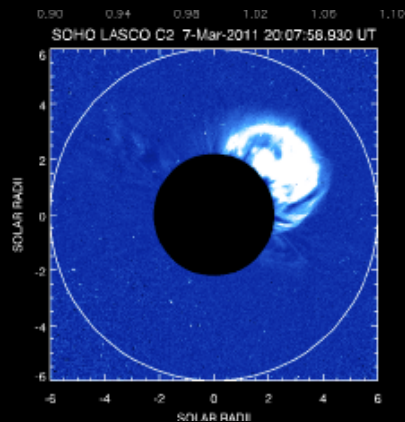
Eruptive Event Generator with Gibson-Low Configuration (EEGGL)



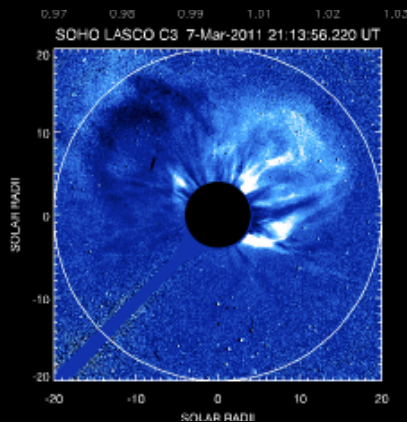
- Blue Weighted Center of Negative Polarity
- Red Weighted Center of Positive Polarity
- Green Polarity Inversion Line

The Recommended GL FLux Rope Parameters		
947,	Latitude:	27.46
	Longitude:	158.00
	Orientation:	276.67
	Radius:	0.80
	Bstrength:	2.25
	Stretch (FIXED):	0.60
	Distance (FIXED):	1.80

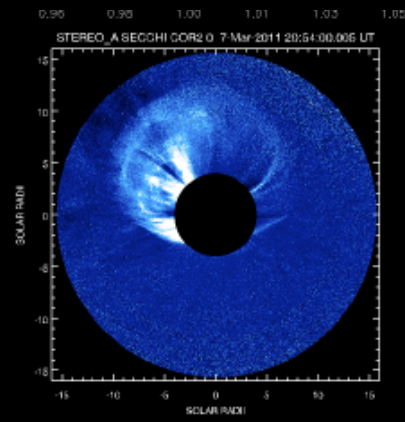
White Light Images



LASCO C2

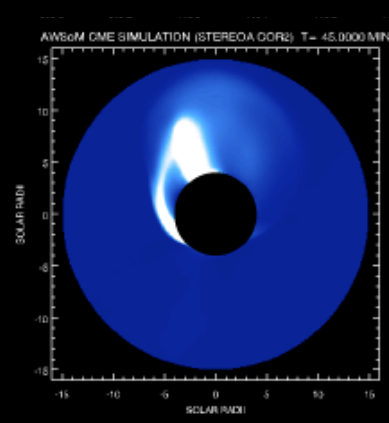
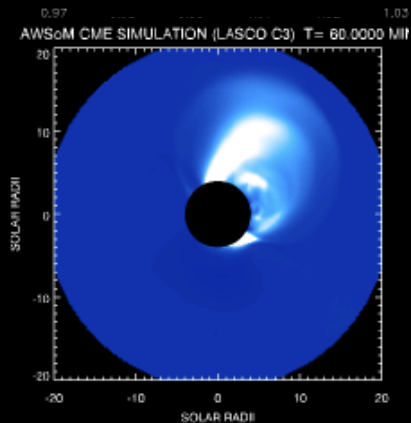
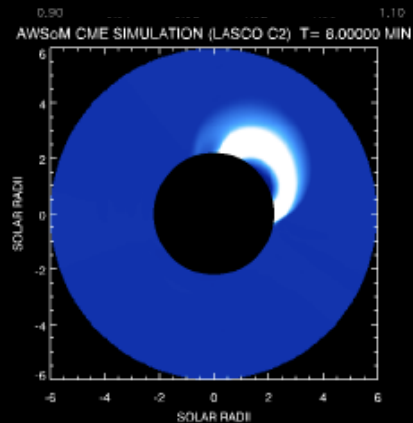


LASCO C3



STEREO A COR2

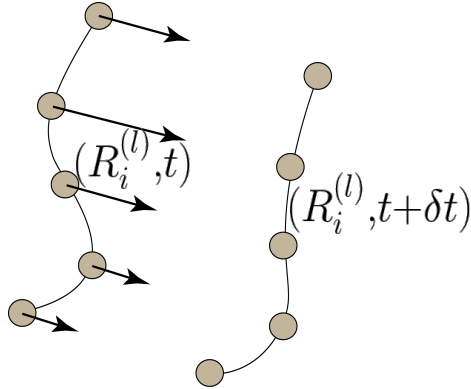
Observation



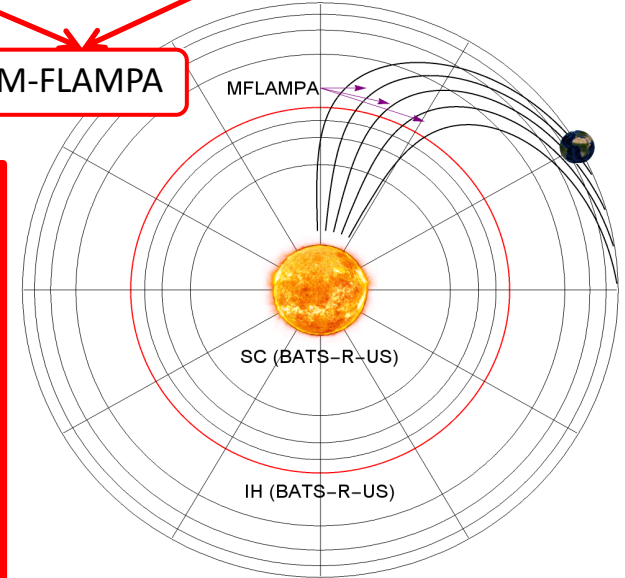
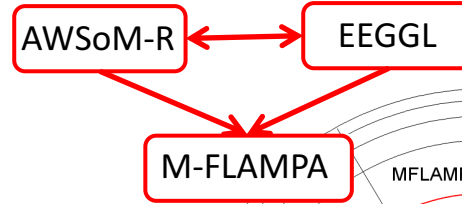
Simulation

SWMF/AWS-M-R + EEGGL + M-FLAMPA

$$\frac{Df}{Dt} + \frac{1}{3} \frac{D \ln \rho}{Dt} \frac{\partial f}{\partial \ln p} = B \frac{\partial}{\partial s} \left(\frac{\kappa}{B} \frac{\partial f}{\partial s} \right)$$



- Solve the Parker equation in the Lagrangian system
- Transforms a 3-D problem to a multitude of 1-D problems
- Field lines are evolving with the AWS-M-R + EEGGL solution



Summary

- SWMF/Geospace is widely used at the CCM and is transitioned to NOAA/SWPC
 - It is regularly updated and improved using CCMC and SWPC feedback
- During the first half of this NASA/NSF project the SWMF/AWS-M and SWMF/AWS-M-R were transitioned to CCMC
- The first magnetically driven CME initiator, SWMF/EEGGL, was transitioned to CCMC at the end of 2016 and it is now available for RoR
- M-FLAMPA is in the final stages of development and it will be transitioned to CCMC in calendar 2017